2.5
2.8
3.2
2.2
3.6
2.0
4.0
100 mm
1.0
1.1
1.25
1.4
1.6
1.8
2.5
2.8
3.2
2.2
3.6
2.0
4.0
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz1234567890
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890
1.0 mm
1.5 mm
2.0 mm
A5
2.0
2.2
2.5
2.8
3.2
3.6
4.0
2.0
2.2
2.5
2.8
3.2
3.6
4.0

DOCUMENT RESUME

ED 279 806 CE 046 465

TITLE Learning Activity Packets for Milling Machines. Unit III--Vertical Milling Machines.

INSTITUTION Oklahoma State Board of Vocational and Technical Education, Stillwater. Curriculum and Instructional Materials Center.

PUB DATE 82

NOTE 26p.; For related teacher's guide and packets, see ED 236 346 and CE 046 463-464.

AVAILABLE FROM Curriculum and Instructional Materials Center, Oklahoma State Board of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, OK 74074 (Order No. TI 0311--$2.00; slides and audiotapes--$350.00).

PUB TYPE Guides - Classroom Use - Materials (For Learner) (051)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.

DESCRIPTORS Behavioral Objectives; Competency Based Education; *Equipment Maintenance; *Equipment Utilization; Learning Activities; *Machine Tool Operators; *Machine Tools; *Metal Working; Safety; Secondary Education; Sheet Metal Work; *Trade and Industrial Education

ABSTRACT

This learning activity packet (LAP) outlines the study activities and performance tasks covered in a related curriculum guide on milling machines. The course of study in this LAP is intended to help students learn to set up and operate a vertical mill. Tasks addressed in the LAP include mounting and removing cutters and cutter holders for vertical spindle machines; using machine controls properly; mounting and aligning a vise; aligning a head square to a table; performing side and end milling operations; milling a key seat with a keyseat cutter and a key slot with an end mill; milling a rectangular pocket; performing precision locating, drilling, and reaming of holes; aligning a bore concentric to the spindle; performing a boring operation; and performing drilling and milling operations using a dividing head. Included in the LAP are unit and specific objectives, a pretest, information and assignment sheets, cross-references to the curriculum guide, job sheets, and answers to the pretest and the assignment sheets. Page numbers in the LAP are coordinated with those in the curriculum guide. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED279806

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for MILLING MACHINES

LAP NO. _____ CODE: _____

INSTRUCTIONAL UNIT

UNIT III--VERTICAL MILLING MACHINES

LEARNING ACTIVITY PACKET NO. 3 **PREREQUISITE LAP(S)** 1

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Vertical Milling Machines." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this speciality.

INTRODUCTION: The course of study in this LAP will help the student become able to set up and operate a vertical mill.

TASKS INCLUDED IN THIS LAP:

1. Mount and remove cutters and cutter holders for vertical spindle machines.
2. Use machine controls properly.
3. Mount and align vise.
4. Align head square to table.
5. Perform a side milling operation.
6. Perform an end milling operation.
7. Mill a key seat with keyseat cutter and a key slot with end mill.
8. Mill a rectangular pocket.
9. Perform precision locating, drilling, and reaming of holes.
10. Align a bore concentric to the spindle.
11. Perform a boring operation.
12. Perform drilling and milling operations using dividing head.

TI0311

CE 046 465

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
FRANCIS TUTTLE, DIRECTOR • 1515 WEST SIXTH AVE., • STILLWATER, OKLAHOMA 74074 • A.C. (405) 377-2000

User of LAP:

Included in this LAP are the answers to the pre-test and answers to the assignment sheets. If you desire to evaluate these two components, then it will be your responsibility to remove these components from the LAP prior to giving to the student. If you desire for the student to assume the responsibility for self-evaluation, then we would suggest that you leave the components contained as part of the LAP.

We hope this developmental design proves to be beneficial to you.

Sincerely,

Bob Patton, Coordinator
Curriculum and Instructional
Materials Center

BP:jd

EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER

82-000704

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____ 1.	Read	Unit and Specific Objectives, page MM-223.
_____ 2.	Complete	Vertical Milling Pretest, LAP page 15.
_____ 3.	Study	The sections of the Information Sheet, pages MM--227 through MM--233, indicated by your instructor on your Pretest.
_____ 4.	Refer	To Step 3 of your Pretest. If additional study is indicated for Information Sheet, Section I, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____ 5.	Do	LAP Assignment Sheet #1, LAP page 19.
_____ 6.	Do	LAP Assignment Sheet #2, LAP page 21.
_____ 7.	Refer	To Step 3 of your Pretest. If additional study is indicated for Information Sheet, Section II, continue to Learning Step 8. Otherwise, proceed to Learning Step 11.
_____ 8.	Do	Assignment Sheet #1--List Required Milling Operations, pages MM-235 through MM-237.
_____ 9.	Stop.	Have your instructor evaluate Assignment Sheet #1. If your instructor is satisfied with your performance, proceed to Learning Step 11. Otherwise, continue to Learning Step 10.

LEARNING STEPS

_____10. Do LAP Assignment Sheet #3, LAP page 23.

_____11. Check The following tasks that you think you can perform without supervision.

Student Check		Instructor Initials/Date Skilled	Moderately Skilled
_____	a. Mount and remove cutters and cutter holders for vertical spindle machines (14)	_____	_____
_____	b. Use machine controls properly (20)	_____	_____
_____	c. Mount and align vise (26)	_____	_____
_____	d. Align head square to table (32)	_____	_____
_____	e. Perform a side milling operation (38)	_____	_____
_____	f. Perform an end milling operation (44)	_____	_____
_____	g. Mill a key seat with keyseat cutter and a key slot with end mill (50)	_____	_____
_____	h. Mill a rectangular pocket (56)	_____	_____
_____	i. Perform precision locating, drilling, and reaming of holes (62)	_____	_____
_____	j. Align a bore concentric to the spindle (68)	_____	_____
_____	k. Perform a boring operation (74)	_____	_____
_____	l. Perform drilling and milling operations using dividing head (80)	_____	_____

_____12.	Discuss	Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 86. Otherwise, continue to Learning Step 13.
_____13.	Refer	To Learning Step 11a. If this task has been initialed by your instructor, proceed to Learning Step 19. Otherwise, continue to Learning Step 14.
_____14.	Study	Job Sheet #1--Mount and Remove Cutters and Cutter Holders for Vertical Spindle Machines, pages MM-241 through MM-243.
_____15.	Watch	Slide/tape presentation, "Mount and Remove Cutters and Cutter Holders for Vertical Spindle Machines," (MM-III-1).
_____16.	Do	Job Sheet #1--Mount and Remove Cutters and Cutter Holders for Vertical Spindle Machines.
_____17.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11a, and proceed to Learning Step 19. Otherwise, repeat Learning Steps 14 through 16 and then continue to Learning Step 18.
_____18.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11a, and continue to Learning Step 19. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11a, and continue to Learning Step 19.
_____19.	Refer	To Learning Step 11b. If this task has been initialed by your instructor, proceed to Learning Step 25. Otherwise, continue to Learning Step 20.

_____20.	Study	Job Sheet #2--Use Machine Controls Properly, pages MM-245 through 248.
_____21.	Watch	Slide/tape presentation, "Use Machine Controls Properly," (MM-III-2).
_____22.	Do	Job Sheet #2--Use Machine Controls Properly.
_____23.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11b, and proceed to Learning Step 25. Otherwise, repeat Learning Steps 20 through 22 and then continue to Learning Step 24.
_____24.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11b, and continue to Learning Step 25. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11b, and continue to Learning Step 25.
_____25.	Refer	To Learning Step 11c. If this task has been initialed by your instructor, proceed to Learning Step 31. Otherwise, continue to Learning Step 26.
_____26.	Study	Job Sheet #3--Mount and Align Vise, pages MM-249 through MM-253.
_____27.	Watch	Slide/tape presentation, "Mount and Align Vise" (MM-III-3).
_____28.	Do	Job Sheet #3--Mount and Align Vise.

_____29.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11c, and proceed to Learning Step 31. Otherwise, repeat Learning Steps 26 through 28 and then continue to Learning Step 30.
_____30.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11c, and proceed to Learning Step 31. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11c, and continue to Learning Step 31.
_____31.	Refer	To Learning Step 11d. If this task has been initialed by your instructor, proceed to Learning Step 37. Otherwise, continue to Learning Step 32.
_____32.	Study	Job Sheet #4--Align Head Square to Table, pages MM-255 through 262.
_____33.	Watch	Slide/tape presentation, "Align Head Square to Table" (MM-III-4).
_____34.	Do	Job Sheet #4--Align Head Square to Table.
_____35.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11d, and proceed to Learning Step 37. Otherwise, repeat Learning Steps 32 through 34 and then continue to Learning Step 36.

_____36.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11d, and continue to Learning Step 37. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11d, and continue to Learning Step 37.
_____37.	Refer	To Learning Step 11e. If this task has been initialed by your instructor, proceed to Learning Step 43. Otherwise, continue to Learning Step 38.
_____38.	Study	Job Sheet #5--Perform a Side Milling Operation, pages MM-263 through MM-271.
_____39.	Watch	Slide/tape presentation, "Perform a Side Milling Operation" (MM-III-5).
_____40.	Do	Job Sheet #5--Perform a Side Milling Operation.
_____41.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11e, and proceed to Learning Step 43. Otherwise, repeat Learning Steps 38 through 40 and then continue to Learning Step 42.
_____42.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11e, and continue to Learning Step 43. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11e, and continue to Learning Step 43.

____43.	Refer	To Learning Step 11f. If this task has been initialed by your instructor, proceed to Learning Step 49. Otherwise, continue to Learning Step 44.
____44.	Study	Job Sheet #6--Perform an End Milling Operation, pages MM-273 through MM-277.
____45.	Watch	Slide/tape presentation, "Perform an End Milling Operation" (MM-III-6).
____46.	Do	Job Sheet #6--Perform an End Milling Operation.
____47.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11f, and proceed to Learning Step 49. Otherwise, repeat Learning Steps 44 through 46 and then continue to Learning Step 48.
____48.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11f, and continue to Learning Step 49. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11f, and continue to Learning Step 49.
____49.	Refer	To Learning Step 11g. If this task has been initialed by your instructor, proceed to Learning Step 55. Otherwise, continue to Learning Step 50.
____50.	Study	Job Sheet #7--Mill a Key Seat with Keyseat Cutter and a Key Slot with End Mill, pages MM-279 through MM-287.

_____51.	Watch	Slide/tape presentation, "Mill a Key Seat with Keyseat Cutter and a Key Slot with End Mill" (MM-III-7).
_____52.	Do	Job Sheet #7--Mill a Key Seat with Keyseat Cutter and a Key Slot with End Mill.
_____53.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11g, and proceed to Learning Step 55. Otherwise, repeat Learning Steps 49 through 52 and then continue to Learning Step 54.
_____54.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11g, and continue to Learning Step 55. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11g, and continue to Learning Step 55.
_____55.	Refer	To Learning Step 11h. If this task has been initialed by your instructor, proceed to Learning Step 61. Otherwise, continue to Learning Step 56.
_____56.	Study	Job Sheet #8--Mill a Rectangular Pocket, pages MM-289 through MM-299.
_____57.	Watch	Slide/tape presentation, "Mill a Rectangular Pocket" (MM-III-8).
_____58.	Do	Job Sheet #8--Mill a Rectangular Pocket.

_____59.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11h, and proceed to Learning Step 61. Otherwise, repeat Learning Steps 56 through 58 and then continue to Learning Step 60.
_____60.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11h, and continue to Learning Step 61. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 61.
_____61.	Refer	To Learning Step 11i. If this task has been initialed by your instructor, proceed to Learning Step 67. Otherwise, continue to Learning Step 62.
_____62.	Study	Job Sheet #9--Perform Precision Locating, Drilling, and Reaming of Holes, pages MM-301 through MM-307.
_____63.	Watch	Slide/tape presentation, "Perform Precision Locating, Drilling, and Reaming of Holes" (MM-III-9).
_____64.	Do	Job Sheet #9--Perform Precision Locating, Drilling, and Reaming of Holes.
_____65.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11i, and proceed to Learning Step 67. Otherwise, repeat Learning Steps 62 through 64 and then continue to Learning Step 66.

_____66.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11i, and continue to Learning Step 67. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11i, and continue to Learning Step 67.
_____67.	Refer	To Learning Step 11j. If this task has been initialed by your instructor, proceed to Learning Step 73. Otherwise, continue to Learning Step 68.
_____68.	Study	Job Sheet #10--Align a Bore Concentric to the Spindle, pages MM-309 through 312.
_____69.	Watch	Slide/tape presentation, "Align a Bore Concentric to the Spindle" (MM-III-10).
_____70.	Do	Job Sheet #10--Align a Bore Concentric to the Spindle.
_____71.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11j, and proceed to Learning Step 73. Otherwise, repeat Learning Steps 68 through 70 and then continue to Learning Step 72.
_____72.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11j, and continue to Learning Step 73. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11j, and continue to Learning Step 73.

_____73.	Refer	To Learning Step 11k. If this task has been initialed by your instructor, proceed to Learning Step 79. Otherwise, continue to Learning Step 74.
_____74.	Study	Job Sheet #11--Perform a Boring Operation, pages MM-313 through 316.
_____75.	Watch	Slide/tape presentation, "Perform a Boring Operation" (MM-III-11).
_____76.	Do	Job Sheet #11--Perform a Boring Operation.
_____77.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11k, and proceed to Learning Step 79. Otherwise, repeat Learning Steps 74 through 76 and then continue to Learning Step 78.
_____78.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11k, and continue to Learning Step 79. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11k, and continue to Learning Step 79.
_____79.	Refer	To Learning Step 11L. If this task has been initialed by your instructor, proceed to Learning Step 85. Otherwise, continue to Learning Step 80.
_____80.	Study	Job Sheet #12--Perform Drilling and Milling Operations Using Dividing Head, pages MM-317 through MM-323.

LEARNING STEPS

_____81.	Watch	Slide/tape presentation, "Perform Drilling and Milling Operations Using Dividing Head" (MM-III-12).
_____82.	Do	Job Sheet #12--Perform Drilling and Milling Operations Using Dividing Head.
_____83.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11L and proceed to Learning Step 85. Otherwise, repeat Learning Steps 80 through 82 and then continue to Learning Step 84.
_____84.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11L, and continue to Learning Step 85. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction have your instructor initial Learning Step 11L, and continue to Learning Step 85.
_____85.	Refer	To Learning Step 11. If all tasks have been initialed by your instructor, continue to Learning Step 86. Otherwise, refer to the Learning Step indicated in parentheses after the unsigned task.
_____86.	Review	Information Sheet (pages MM-227 through MM-233), Assignment Sheet, and LAP Assignment Sheets.
_____87.	Take	Vertical Milling Machines Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

PRETEST

NAME _____ SCORE _____

DIRECTIONS: The purpose of this pretest is to determine how much you already know about vertical milling machines. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing may keep you from receiving needed instruction.

1. Match terms and definitions associated with vertical milling machines. Write the correct numbers in the blanks.

_____a.	Final cut to a surface to obtain desired smoothness	1. Teeth marks
_____b.	Device installed in spindle that provides for quickly securing or removing cutting tools by turning a spring-loaded cam	2. Spindle direction
_____c.	Movement of chips away from cutter and workpiece; caused by use of cutting fluid	3. Super spacer
_____d.	Hardened-steel sleeve with threads on one end used to hold standard-diameter tool shanks	4. Finish cut
_____e.	Work-holding device mounted to milling machine with chuck in vertical or horizontal position; designed to be used with indexing plate by moving in uniform increments for rapid indexing	5. Cam-lock adapter
_____f.	Clockwise or counterclockwise direction of spindle rotation	6. Chip flow
_____g.	Deviations from a perfect plain surface caused by cutting action	7. Collet

2. Identify the following vertical milling operations by writing the correct names in the blanks.

Pocket milling	Boring
Drilling or reaming holes	Slotting
Side end milling	End milling
Squaring	Milling key slots and key seats
Indexing	Angular milling
Fly-cutting	

a. _____--Producing a large flat surface 90 degrees to axis of spindle with cutter or cutters mounted to a holder

b. _____--Producing or finishing holes that require precise locations

c. _____--Milling an angle on a workpiece with reference to a designated surface

d. _____--Cutting a recess with a flat bottom and straight walls, or flat bottom and straight walls joined with a fillet

e. _____--Milling a surface parallel to axis of spindle by using periphery of end mill or shell mill cutter

f. _____--Rotating workpiece a specific fractional amount of a turn to perform repeated milling operations

g. _____--Cutting slots to receive keys

h. _____--Using a single-point tool to enlarge a hole by means of an adjustable head

i. _____--Milling a surface at 90 degrees to axis of spindle by using a solid-shank cutting tool or an adapter-held shell end mill

j. _____--Cutting surfaces of a workpiece at 90-degree angles to each other

k. _____--Producing a recess with a flat bottom and straight sides

17

3. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

   Refer to the Information Sheet, Section(s)

   _____ I _____ II

   You came here from Learning Step 2. If neither of the above sections is checked, proceed to Learning Step 11. Otherwise, continue to Learning Step 3.

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Write in the blanks the correct terms for the following definitions.

Teeth marks	Chip flow
Super spacer	Cam-lock adapter
Spindle direction	Finish cut
Collet	

a. _____--Final cut to a surface to obtain desired smoothness

b. _____--Device installed in a spindle that provides for quickly securing or removing cutting tools by turning a spring-loaded cam

c. _____--Movement of chips away from cutter and workpiece; caused by use of cutting fluid

d. _____--Hardened-steel sleeve with threads on one end used to hold standard-diameter tool shanks

e. _____--Work-holding device mounted to milling machine with chuck in vertical or horizontal position; designed to be used with indexing plate by moving in uniform increments for rapid indexing

f. _____--Clockwise or counterclockwise direction of spindle rotation

g. _____--Deviations from a perfect plain surface caused by cutting action

2. Stop. Have your instructor evaluate your LAP Assignment Sheet and mark the appropriate blank below.

_____ Refer to Information Sheet, Section I for additional study, and then continue to Learning Step 6.

_____ Proceed to Learning Step 7.

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Fill in the missing words to complete the following terms and definitions associated with vertical milling machines.

   a. COLLET--Hardened-steel _____ with threads on one end used to hold standard-diameter tool shanks

   b. FINISH CUT--Final cut to a surface to obtain desired _____.

   c. CHIP FLOW--Movement of chips _____ _____ cutter and workpiece; caused by use of cutting fluid

   d. CAM-LOCK ADAPTER--Device installed in spindle that provides for quickly securing or removing _____ _____ by turning a spring-loaded cam

   e. _____ _____--Deviations from a perfect plain surface caused by cutting action

   f. SUPER SPACER--Work-holding device mounted to milling machine with chuck in vertical or horizontal position; designed to be used with indexing plate by moving in uniform increments for _____ _____

   g. SPINDLE _____--Clockwise or counterclockwise direction of spindle rotation

2. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

LAP ASSIGNMENT SHEET #3

NAME _____ SCORE _____

1. Complete the following descriptions of vertical milling machines by writing the correct words in the blanks.

   a. SIDE END MILLING--Milling a surface parallel to axis of spindle by using _____ of end mill or shell mill cutter

   b. END MILLING--Milling a surface at 90 degrees to axis of spindle by using a _____ cutting tool or an _____ shell end mill

   c. DRILLING OR REAMING HOLES--Producing or finishing holes that require _____ _____

   d. SLOTTING--Producing a recess with a flat _____ and straight _____

   e. POCKET MILLING--Cutting a recess with a flat bottom and straight walls, or flat bottom and straight walls joined with a _____

   f. BORING--Using a _____ tool to enlarge a hole by means of an adjustable head

   g. MILLING KEY SLOTS AND KEY SEATS--Cutting slots to receive _____

   h. SQUARING--Cutting surfaces of a workpiece at _____ angles to each other

   i. ANGULAR MILLING--Milling an _____ on a workpiece with reference to a designated surface

   j. INDEXING--_____ workpiece a specific fractional amount of a turn to perform repeated milling operations

k. FLY-CUTTING--Producing a large flat surface 90 degrees to axis of spindle with cutter or cutters mounted to a _____

2. Identify the following vertical milling operations by writing the correct names in the blanks. Check your answers to this question against your work in question 1.

a. _____--Producing a large flat surface 90 degrees to axis of spindle with cutter or cutters mounted to a holder

b. _____--Producing or finishing holes that require precise locations

c. _____--Milling an angle on a workpiece with reference to a designated surface

d. _____--Cutting a recess with a flat bottom and straight walls, or flat bottom and straight walls joined with a fillet

e. _____--Milling a surface parallel to axis of spindle by using periphery of end mill or shell mill cutter

f. _____--Rotating workpiece a specific fractional amount of a turn to perform repeated milling operations

g. _____--Cutting slots to receive keys

h. _____--Using a single-point tool to enlarge a hole by means of an adjustable head

i. _____--Milling a surface at 90 degrees to axis of spindle by using a solid-shank cutting tool or an adapter-held shell end mill

j. _____--Cutting surfaces of a workpiece at 90-degree angles to each other

k. _____--Producing a recess with a flat bottom and straight sides

3. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 11. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 11.

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

ANSWERS TO PRETEST

1. a. 4
   b. 5
   c. 6
   d. 7
   e. 3
   f. 2
   g. 1

2. a. Fly-cutting
   b. Drilling or reaming holes
   c. Angular milling
   d. Pocket milling
   e. Side end milling
   f. Indexing
   g. Milling key slots and key seats
   h. Boring
   i. End milling
   j. Squaring
   k. Slotting

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #1

1. a. Finish cut

   b. Cam-lock adapter

   c. Chip flow

   d. Collet

   e. Super spacer

   f. Spindle direction

   g. Teeth marks

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #2

1. a. Sleeve
   b. Smoothness
   c. Away from
   d. Cutting tools
   e. Teeth marks
   f. Rapid indexing
   g. Direction

MILLING MACHINES
UNIT III--VERTICAL MILLING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #3

1. a. Periphery
   b. Solid-shank, adapter-held
   c. Precise locations
   d. Bottom, sides
   e. Fillet
   f. Single-point
   g. Keys
   h. 90-degree
   i. Angle
   j. Rotating
   k. Holder

2. a. Fly-cutting
   b. Drilling or reaming holes
   c. Angular milling
   d. Pocket milling
   e. Side end milling
   f. Indexing
   g. Milling key slots and key seats
   h. Boring
   i. End milling
   j. Squaring
   k. Slotting